



EPA Region 7 TMDL Review

TMDL ID: KS-LR-04-061601_LM **Waterbody ID:** KS-LR-04-LM061601 and KS-LR-04-LM061301
Waterbody Name: Cedar Lake and Lake Olathe
Tributary: Cedar Creek
Pollutant: EUTROPHICATION
State: KS **HUC:** 10270104
Basin: Lower Kansas River
Submittal Date: 1/9/2007
Approved: Yes

Submittal Letter

State submittal letter indicates final TMDL(s) for specific pollutant(s)/water(s) were adopted by the state, and submitted to EPA for approval under section 303(d) of the Clean Water Act.

The TMDL for Cedar Lake and Lake Olathe was formally submitted by the Kansas Department of Health and Environment (KDHE) in a letter received by EPA on December 11, 2006. The public comments and KDHE's response to those comments were formally submitted by KDHE in a letter received by EPA on January 9, 2007. Revisions to the TMDL were submitted May 17, 2007 and July 20, 2007. Cedar Lake is a phase II TMDL. The original TMDL was approved in January 26, 2000.

Water Quality Standards Attainment

The water body's loading capacity for the applicable pollutant is identified and the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources is described. TMDL and associated allocations are set at levels adequate to result in attainment of applicable water quality standards.

The loading capacity is set to target the annual amount of total phosphorus (TP) that Cedar Lake and Lake Olathe can receive to meet their designated uses. To address the identified pollutant (eutrophication), a chlorophyll-a (Chla) state concentration of 12 ug/L and an ultimate city goal of 10 ug/L was used to link the concentration of TP to the quantity of eutrophication. A single incident maximum concentration of 20 ug/L is also established to reduce the frequency of taste and odor problems. A Secchi depth (SD) of 1m will also be used to assess aesthetic quality. Water quality standards (WQS) should be attained.

Because lake conditions represent responses to environmental load occurring over an extended period of time, expression of the load as an average annual value is the preferred approach found in current scientific limnological literature. Expressing the TMDL in daily time steps would mislead the reader by implying a daily response to change in daily loading. Although a short-term response after a precipitation event could have localized lake effects, Kansas assesses the mean conditions of their lakes over the growing season, for example an average of 3 samples per summer over multiple years. The growing season mean is affected by factors such as the following: internal lake nutrient loading, water residence time, wind action, and the interaction between light penetration, nutrients, turbidity, sediment load, and algal response.

Numeric Target(s)

Submittal describes applicable water quality standards, including beneficial uses, applicable numeric and/or narrative criteria. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, site specific if possible, was developed from a narrative criterion and a description of the process used to derive the target is included in the submittal.

Designated uses of Cedar Lake and Lake Olathe are:

- Primary Contact Recreation (A for Lake Olathe and B for Cedar Lake)
- Expected Aquatic Life Support
- Domestic Water Supply
- Food Procurement Use
- Industrial Water Supply

WQS-

Nutrients – Narratives: The introduction of plant nutrients into streams, lakes or wetland from artificial sources shall be controlled to prevent the accelerated succession or replacement of aquatic biota or the production of undesirable quantities or kinds of aquatic life (KAR 28-16-28e(c)(2)(B)).

Narrative: The introduction of plant nutrients into surface waters designated for primary or secondary contact recreational use shall be controlled to prevent the development of objectionable concentrations of algae or algal by-products or nuisance growths of submersed, floating, or emergent aquatic vegetation. (KAR 28-16-28e(c)(7)(A)).

Eutrophication:

Chla water quality state endpoint for primary recreation is 12 ug/L Chla.

Chla water quality ultimate city endpoint is 10 ug/L Chla for Lake Olathe.

Chla maximum single incident occurrence is 20 ug/L Chla.

Current conditions of Cedar Lake show the average Chla at 41 ug/L Chla and a Trophic State Index (TSI) of 67.0.

Current conditions of Lake Olathe show the average Chla at 19.4 ug/L and a TSI of 59.7. High Chla appear when inorganic turbidity values were low.

TP averages for Cedar Lake are 115 ug/L and for Lake Olathe 50 ug/L.

Chla/TP index values and TN:TP ratios all suggest that phosphorus and light appear to be the primary limiting factor. In support of the Chla endpoints, in-lake average concentrations of TP will need to be 35 ug/L and a maximum level set at 50 ug/L. Additionally, SD depths of greater than 1m will also be used for the desired lake clarity.

The state deems these conditions as not complying with their narrative WQS. The State of Kansas does not have numeric criterion for nutrients in their WQS. The lakes exceeded the narrative WQS which states that "water shall be free from" aesthetically objectionable conditions.

Numeric Target(s) and Pollutant(s) of concern

An explanation and analytical basis for expressing the TMDL through surrogate measures (e.g., parameters such as percent fines and turbidity for sediment impairments, or chlorophyll-a and phosphorus loadings for excess algae) is provided, if applicable. For each identified pollutant, the submittal describes analytical basis for conclusions, allocations and margin of safety that do not exceed the load capacity.

The State of Kansas does not have numeric criterion for nutrients in their WQS.

A concentration of 12 ug/L Chla is needed to attain the primary contact recreation use and a concentration of 20 ug/L Chla is added as a maximum single incident occurrence. An ultimate 84% load reduction for TP is required to reach the endpoint for Lake Olathe. This reduction of TP and TN loading is an established link in the reduction of Chla concentrations. Chla concentrations are linked to eutrophication through TSI.

The CNET model was used to calculate all loadings. Vollenweider's (1976) phosphorus sedimentation model was used to predict in-lake phosphorus levels.

The original TMDL for Cedar Lake called for a reduction in TP loading from an estimated current condition of 3,748 lbs/yr to 911 lbs/yr a 73% reduction. However, more detailed data on the hydrology and loading into Cedar Lake estimates long term overland loading of 14,700 lbs/yr but only 7% of that would be biologically available. This TMDL revises the expected load reduction necessary to achieve a Chla concentration of 12 ug/L to 66%, from 14,700 lbs/yr to 5,000 lbs/yr.

Source Analysis

Important assumptions made in developing the TMDL, such as assumed distribution of land use in the watershed, population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources, are described. Point, non point and background sources of pollutants of concern are described, including magnitude and location of the sources. Submittal demonstrates all significant sources have been considered.

There are seven NPDES permitted facilities located within the watershed.

Permit Number	Facility Name	Facility Type	Design Flow	Discharge Type
I-KS52-PO08	Shawnee Rock Plant #3	Limestone Quarry	Sporadic	Stormwater
I-KS52-PO07	Olathe Aggregates Asphalt Sales	Limestone Quarry	Sporadic	Stormwater
I-KS52-PO09	Johnson County Aggregates	Limestone Quarry	Sporadic	Stormwater
I-KS52-PO10	Holland Corporation	Aggregates & Concrete	Sporadic	Stormwater
I-KS52-PR02	Kincaid Ready Mix Concrete	Aggregates & Concrete	Sporadic	Stormwater
I-KS32-NP07	Century Concrete	Aggregates & Concrete	0.001 MGD	Stormwater
M-KS52-NO01	Lakestona Lagoons	Wastewater Lagoon used for Irrigation	Non-Q	Irrigation

There are no confined cattle feedlot operations certified within the watershed. Currently, 9% of land in the watershed is grassland. The grazing density is 19-28 animal units/ square mile.

The City of Olathe is planning to fully urbanize the watershed area within the next 25 to 30 years. After fully developed, the watershed will have 0% cropland and grassland. The urban residential and commercial areas will increase from the current 15% to 62%. The City of Olathe also estimates that the total annual loads of phosphorus and nitrogen will increase to 9,630 pounds and 639,000 pounds, respectively. Urban residential and commercial land use will contribute about 7,500 pounds (78%) of phosphorus and 560,000 (88%) pounds of nitrogen to the watershed. It is expected that the urban runoff will gradually become the major source of nutrient inputs to the watershed during the development.

The atmospheric phosphorus and geological formations (i.e., soil and bedrock) may also contribute to phosphorus loads. Nutrient cycling of the sediment (from wind mixing and bottom feeding fish) is likely contributing available nutrients to the lakes for algal uptake. Some resuspension of sediment may contribute to lake loading. Likewise, bottom-feeding fish may also re-suspend the sediment and thus contribute to loading.

All sources of eutrophication have been considered.

Allocation

Submittal identifies appropriate wasteload allocations for point, and load allocations for nonpoint sources. If no point sources are present the wasteload allocation is zero. If no nonpoint sources are present, the load allocation is zero.

The original TMDL for Cedar Lake called for a reduction in TP loading from an estimated current condition of 3,748 lbs/yr to 911 lbs/yr a 73% reduction. This TMDL revises the expected load reduction necessary to achieve a Chla concentration of 12 ug/L to 66%, from 14,700 lbs/yr to 5,000 lbs/yr. EPA found the justifications for the increased LC, given in the TMDL to be acceptable.

The TMDL document set a TP allocation at 4840 lbs/yr, a Chla state allocation of 12 ug/L, a Chla city ultimate allocation of 10 ug/L, and a SD allocation of 1m for Lake Olathe.

To translate the long-term averages to maximum daily values, the approach used is described in the Technical Support Document for Water Quality-based Toxics Control (EPA/505/2-90-001.) The Maximum Daily Load (MDL) equals the Long Term Average (LTA) * exp (z*sigma - 0.5*sigma^2.) Sediment, nitrogen, and phosphorus are expected to have large coefficients of variation (CV).

WLA Comment

Lake Olathe

Ultimately the area will have an urban build up within 25-30 years. At that time the TP load of 4840 lbs/yr currently assigned to non-point LA will need to transition to the WLA assigned to urban storm water activities and be further reduced by 2000 lbs/yr. Currently about 17% of the watershed is developed, therefore, the current desired load allocation (LA) of 4840 lbs/year (29.3 lbs/day) is distributed by 810 lbs/year (6 lbs/day) to the WLA assigned to urban storm water activities (MS4) in the watershed. The future desired LC which increases to 6230 lbs/year is distributed by 4310 lbs/year (31.9 lbs/day) to the WLA assigned to the MS4 permits.

Cedar Lake

This TMDL revises the expected load reduction necessary to achieve a Chla concentration of 12 ppb to 66% (from 14,760 lbs/yr to 5,028 lbs/yr). WLA assigned to urban storm water is 3960 lbs/yr (29.1 lbs/day).

LA Comment

LA of TP for Lake Olathe is a state goal of 5800 lbs/yr (35.4 lbs/day) and a city goal of 4840 lbs/yr (29.3 lbs/day). An 84% TP reduction is required from the current watershed conditions. This reduction of TP loading will also reduce Chla concentrations.

To attain the Primary Contact Recreation Use WQS, a 12 ug/L Chla concentration is needed with a city goal of 10 u/L Chla.

The original TMDL for Cedar Lake called for a reduction in TP loading from an estimated current condition of 3,748 lbs/year to 911 lbs/year, a 73% reduction. This TMDL revises the expected load reduction from 14,760 lbs/year to 5,028 lbs/year approximately a 67% reduction. The LA for Cedar Lake is 1012 lbs/yr (7.4 lbs/day) which includes 22 lbs/yr (0.16 lbs/day) for air deposition.

Margin of Safety

Submittal describes explicit and/or implicit margin of safety for each pollutant. If the MOS is implicit, the conservative assumptions in the analysis for the MOS are described. If the MOS is explicit, the loadings set aside for the MOS are identified and a rationale for selecting the value for the MOS is provided.

The MOS for Lake Olathe is explicit. The MOS is the difference between the state goal of 12 ug/L and the local city goal of 10 ug/L. This will be an additional 1000 lbs of annual load reduction necessary to achieve the local goal.

The explicit MOS for Cedar Lake is 56 lbs/year (0.41 lbs/day).

The original Cedar Lake MOS was 101 lbs/year of TP taken from the LC to ensure that adequate load reduction occurs.

Seasonal Variation and Critical Conditions

Submittal describes the method for accounting for seasonal variation and critical conditions in the TMDL(s).

This TMDL was developed based on Chla to generalized lake conditions. The annual targets should result in WQS attainment regardless of the season.

Public Participation

Submittal describes public notice and public comment opportunity, and explains how the public comments were considered in the final TMDL(s).

Public Meetings: Public notification of the second round of TMDLs in the Kansas-Lower Republican Basin was made in the Kansas Registrar in January 5, 2006. An active Internet site was established at <http://www.kdheks.gov/tmdl/public.htm> to convey information to the public on the general establishment of TMDLs and specific TMDLs for the Kansas-Lower Republican Basin.

Public Hearing: A Public Hearings on the second round of TMDLs in the Kansas-Lower Republican Basin were held in Olathe on January 19, and in Topeka January 30, 2006. Comments were received from Johnson County Wastewater and Stormwater Programs.

Basin Advisory Committee: The Kansas Lower Republican Basin Advisory Committee met to discuss the second round of TMDLs in the basin on April 7, 2005 in Lawrence, July 26, 2005 in Concordia, October 20, 2005 in Lawrence, and January 24, 2006 in Topeka.

Discussion with the City of Olathe: A meeting to discuss TMDLs of interest to the City of Olathe and Johnson County occurred on December 21, 2005.

Comments and the KDHE responses to the comments were formally submitted to EPA in a letter dated January 9, 2007.

Monitoring Plan for TMDL(s) Under Phased Approach

The TMDL identifies the monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of WQS, and a schedule for considering revisions to the TMDL(s) (where phased approach is used).

The original Cedar Lake TMDL was approved January 26, 2000. Monitoring from USGS gages and surveys by KDHE occurred from 1998-2004.

Additional sampling by the City of Olathe and the USGS is expected to occur in the future. The data collected by those monitoring efforts will assess the degree of effectiveness in abating impacts from the changing watershed above the lakes. These data are not expected to be obtained before 2010 when this TMDL will be revisited for the third cycle in the basin. Raw water taken from the lake should be monitored for nutrient and geosmin content at the Olathe water treatment plant. The implied water quality condition from the water supply data will be examined in 2010 as part of re-visiting this TMDL.

Reasonable assurance

Reasonable assurance only applies when reductions in nonpoint source loading is required to meet the prescribed waste load allocations.

Reasonable assurances are not required because all point sources have adequate WLA requirements. Reasonable assurance includes numerous authorities and funding through the Kansas Water Plan.

